Monte Carlo μ CC Study - Vertex Location

Introduction

A Monte Carlo file of μ CC events is used to study the predicted vertex distribution and compare to the located data events. A total of 300 events was generated, but at this time only 100 events have been refit, with special attention given to finding the track and determining its momentum in a way consistent with data. The resulting momentum spectrum will be reported in another memo since it requires a larger sample in order to study details.

The vertex location was determined manually, so that Vertex Processor 1 data is used to compare with the actual MC location. Care was taken to ensure placement of the transverse position (*u*,*v*) along the muon track to precision of better than 1mm. This memo will be updated in the future when the entire MC data set has been refit.

	N	Σ*w*	%
Trig 1 or 2	97	9949	98.7
Trig 2 only	93	9504	94.3
μ identified	81	9069	90.0
μ id AND Trig 2	77	8624	85.6
μ^-	48	6486	71.5
μ^+	33	2583	28.5
Total	100	10080	100

Table 1. Monte Carlo sample

Results

The vertex distribution differences (fit - MC) are shown in Figures 1 and 2. The transverse distributions show that the estimated vertex is usually within 1mm of the true position, and the *z*-vertex is much worse, with a gaussian standard deviation of 7mm. This is expected for a μ CC sample, since, in general, the muon track is can be isolated as a “key” track to pin down the u and v coordinate. The *z*-distribution is probably representative of any set of interactions. Although the center of the gaussian part is displaced 2mm downstream, there is a long tail of events for which the refit vertex was placed upstream of the MC vertex. Figure 3 shows the same quantities plotted from the located sample (all types of interactions, not just μ CC).

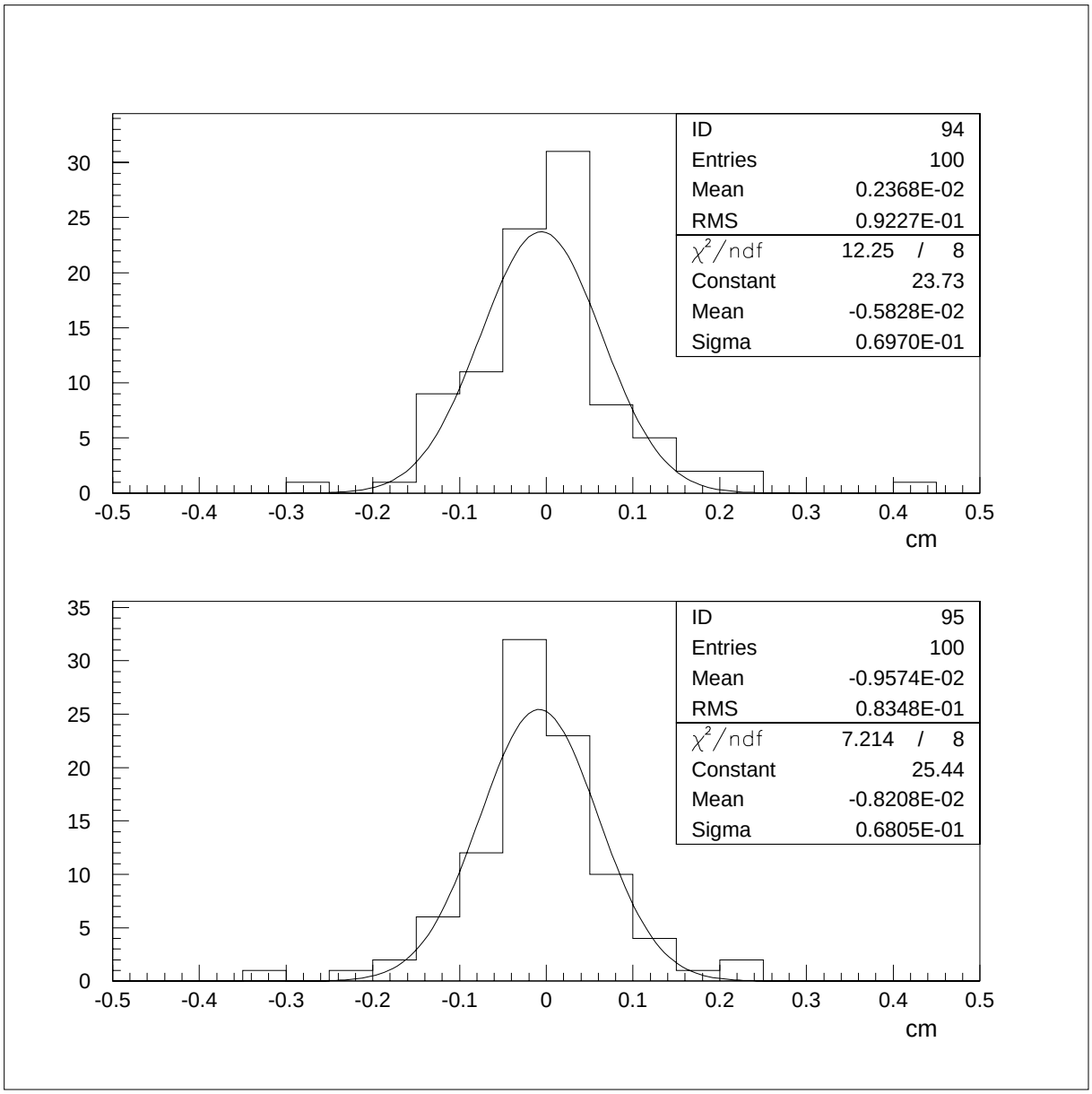

Figure 1. The displacement of the fit vertex relative to the true Monte Carlo vertex in *x* (*top*) and *y* (*bottom*). The distribution is dominated by the nearly gaussian component, with a σ = 0.7mm.

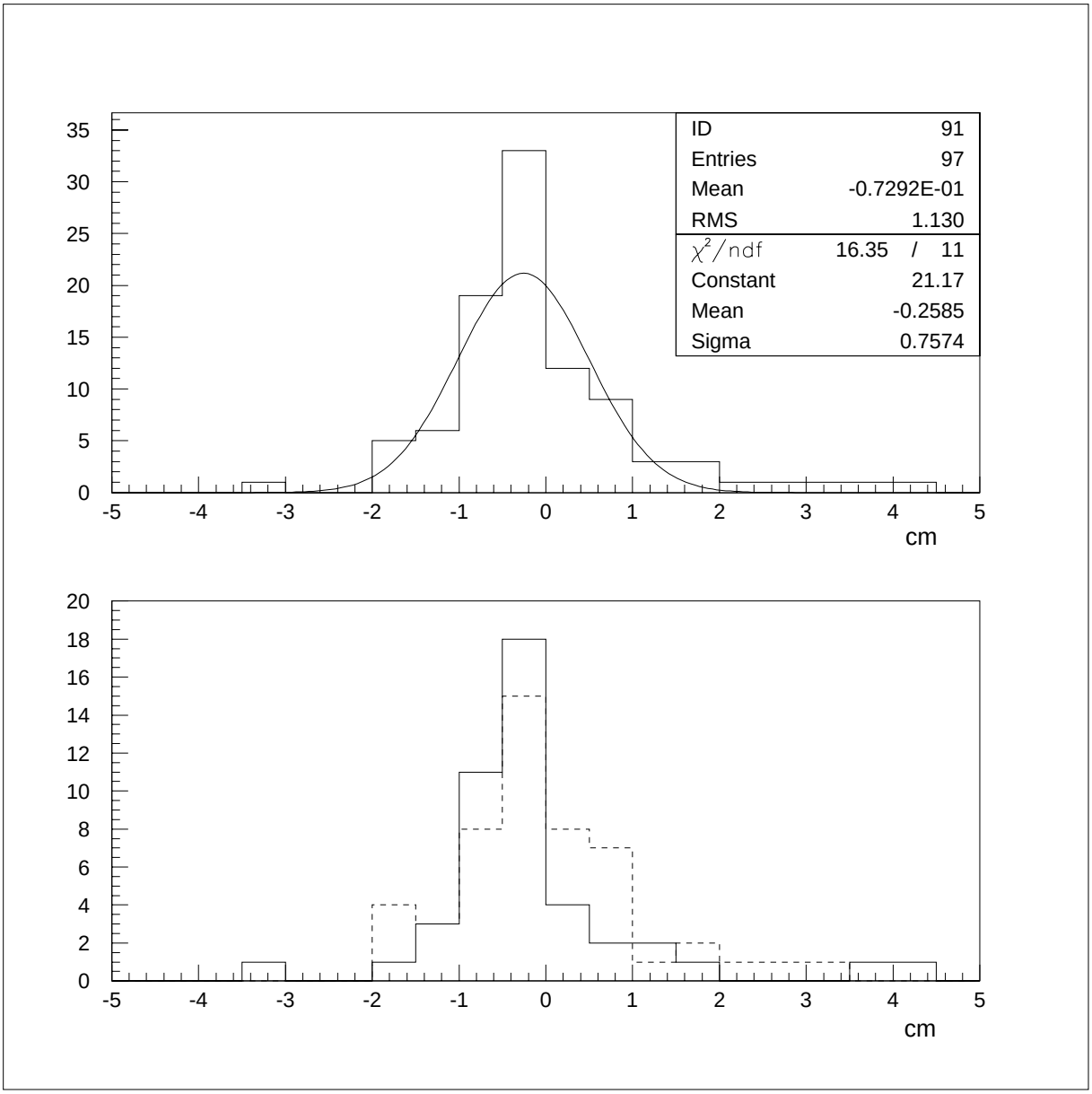

Figure 2. The displacement of the vertex in z, defined as $\delta z = z_{fit} - z_{MC}$. Shown are the total sample (top) and separated into the upstream half of a target module (*bottom*, solid) and downstream half of a module (*bottom*, dashed).

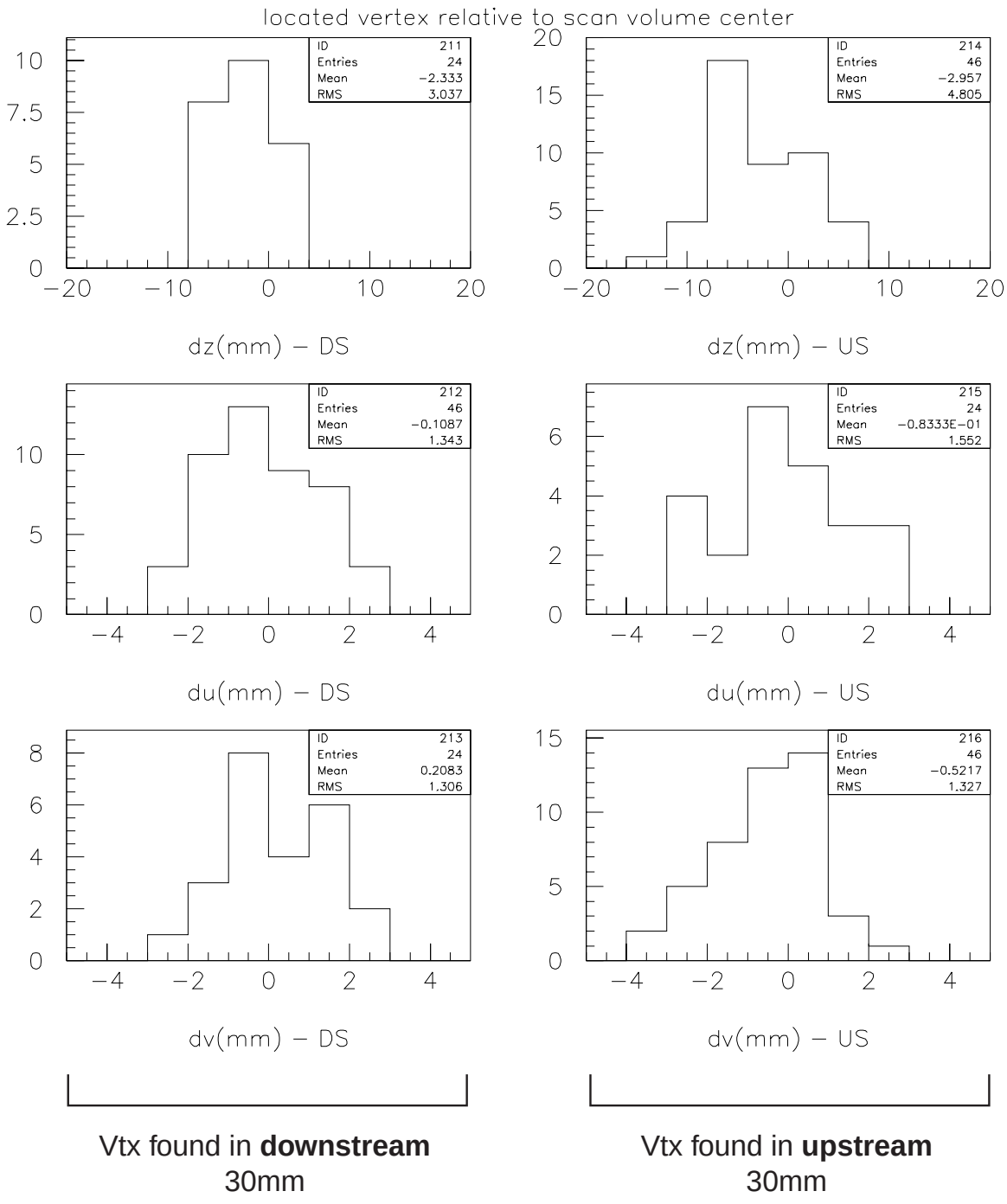

Figure 3. Distributions from located events (actual - fit), to be compared with Figures 1 and 2.